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09/607,488	06/30/2000	Paul A. Griffin	8999-029	2307

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EXAMINER	
AHMED, SAMIR ANWAR	
ART UNIT	PAPER NUMBER
2623	

DATE MAILED: 08/27/2003 3

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/607,488	GRIFFIN, PAUL A.
	Examiner	Art Unit
	Samir A. Ahmed	2623

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-48* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,18-34,44,47 and 48* is/are rejected.

7)☒ Claim(s) *5-17, 35-43, 45-46* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

   The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 20-30 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 20 is an independent claim and makes reference to preceding independent claim 19 to define the encoding limitation. However independent claim 19 makes reference to preceding independent claim 1 to define the sample space construction limitation. The format of making reference to limitations recited in claim 19 results in confusion because it is not clear whether the reference to claim 19 includes only the limitations recited in independent claim 19 or also the limitations of claim 1. The meets and bounds of the claim are not defined and the claim is rendered indefinite.

As to claims 21-30 refer to claim 20 rejection.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-2, 18-20, 31-32, 44, 47, are rejected under 35 U.S.C. 102(b) as being anticipated by Daniel L. Swets et al., "Using Discriminant Eigenfeatures for Image retrieval", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 18, No. 8, pp 831-838, August 1996.

As to claim I, Swets discloses a method of constructing a vector space in which a data sample relating to an object may be encoded, comprising: providing a raw matching score between each of a plurality of basis sample elements and each of a plurality of data samples in a first sample database [an image query (data sample) is projected on each of a training set of images (basis or reference sample elements) in the MEF and MDF subspaces. This projection is in effect an overlap image score to compare the score of the encoded MEF and MDF vectors in eigenspace of the image query with the score of the training set of images obtain a raw matching score (page 834, paragraph 2.3, page 835,. paragraph 4)], the samples in the first sample database being out-of-sample with respect to the basis samples [the test images (plurality of data samples) are a disjoint set (out of sample) of the training images (plurality of basis or reference sample elements) (page 835, LC, lines 3-4 and 29-34)]; and constructing a sample space from the raw matching scores [the MEF and MDF projections construct a sample space from the raw matching scores (Fig. 1) , the sample space being defined by a basis set of sample space modes [the sample space is defined by the principal component directions or modes Y1 (or E) (page 832, LC, lines 1-4, Fig. 1)].

As to claim 2, Swets further discloses, wherein constructing the sample space comprises: generating a covariance matrix for the basis elements from the raw

matching scores; and determining the eigenvectors and eigenvalues of the covariance matrix [the MEF projection score (raw matching score) represents a covariance matrix (page 832, LC, lines 1-13)] the eigenvectors specifying the sample space modes [the eigenvectors specify the principal component directions or modes E of the covariance matrix (page, LC, lines 1-4).

As to claim 18, Swets further discloses, further comprising selecting the plurality of basis sample elements at random (page 835, LC, lines 29-30).

As to claim 19, Swets discloses, a method of encoding a data sample [MEF and MDF approximate the features of the image and reduce the features size (i.e., encoding) (page 831 paragraph 2.1.1)] relating to an object to enable the object to recognized, comprising:

constructing a sample space using the method of claim 1 (refer to claim 1 rejection);

providing a raw matching score between said data sample and each of the plurality of basis sample elements [an image query (data sample) is projected on each of a training set of images (basis or reference sample elements) in the MEF and MDF subspaces. This projection is in effect an overlap image score to compare the score of the encoded MEF and MDF vectors in eigenspace of the image query with the score of the training set of images obtain a raw matching score used for recognition (page 834, paragraph 2.3, page 835, paragraph 4)]; and

mapping the raw matching scores of said data sample into sample space scores [the MEF and MDF projections construct a sample space from the raw matching scores

(Fig. 1), the sample space being defined by a basis set of sample space modes, the sample space is defined by the principal component directions or modes Y1 (or E) (page 832, LC, lines 1-4, Fig. 1)].

As to claim 20, Swets discloses, a method of recognizing whether a probe data sample (query image) matches one of a plurality of known data samples (training image set) comprising:

encoding the known data samples using the method of claim 19 (refer to claim 19 rejection) and storing the results in a reference database [the set of MEF and MDF are generated for each of the training set of images (basis or known or reference samples) and is stored in recognition module (reference database) (page 834, LC, paragraph 2.3);

encoding the probe data samples using the method of claim 19 (refer to claim 19 rejection) [an image query (probe or test data sample) is projected on each of the training set of images (known or reference samples) in the MEF and MDF subspaces, i.e. the MEF and MDF of the probe image is generated and projected on the MEF and MDF of each of the training set of images, which means that the probe image is also encoded in the MEF and MDF subspaces ((page 834, paragraph 2.3, page 835, paragraph 4)];

measuring the distance between the sample space scores for the probe sample and each known sample in the sample space (page 834, paragraph 2.3); and

determining which encoded known sample is nearest to the encoded probe sample in the sample space (page 834, paragraph 2.3).

As to claim 31, refer to claim 1 rejection.

As to claim 32, refer to claim 2 rejection.

As to claim 44, refer to claim 18 rejection.

As to claim 47, Swets further discloses, wherein the objects are persons, the data samples represent faces of the persons, and the system is used to perform face recognition (see Fig. 2).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 3-4, 21-22, 33-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Daniel L. Swets et al., "Using Discriminant Eigenfeatures for Image retrieval", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 18, No. 8, pp 831-838, August 1996 as applied to claims 1 and 31 above and further in view of Baback Moghaddam et al., "Probabilistic Visual Learning for Object Representation", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 19, No. 7, pp 696-710, July 1997.

As to claim 3, Swets further discloses that The MEF projection represents a linear transformation and this projection is also called the principal component analysis (page 832, LC, lines 6-12). Swets does not disclose, further comprising: generating a

rotation matrix, based on the eigenvectors of the covariance matrix, the rotation matrix mapping raw matching scores into sample space scores.

Moghaddam discloses that for a given training set of images, we can form a training set of vectors and obtain the basis functions for the KLT by solving the eigenvalues problem. The unitary eigenvector matrix φ of the covariance matrix Σ defines a coordinate transform (rotation) (generating a rotation matrix). A partial KLT is performed to identify the largest eigenvectors and obtain the principal component feature vector y. The residual error (raw matching score) is computed from the first M principal components (the principal component y is a function of the eigenvector matrix φ) and is decomposed into two subspaces as shown in Fig.2 (i.e. the rotation matrix maps the residual error (row matching score) into two score components one in the sample space and the other one is in the orthogonal subspace (page 698, paragraph 2.2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use Moghaddam teachings to modify the method of Swets by generating a rotation matrix, based on the eigenvectors of the covariance matrix, the rotation matrix mapping raw matching scores into sample space scores in order to decorrelate the data and make explicit the invariant subspaces of the covariance matrix operator Σ.

As to claim 4, both Swets [approximating (truncating) the sample space by selecting the eigenvectors associated with the m largest eigenvalues of the covariance matrix (page 831-page 832, paragraph 2.1), and Moghaddam (page 698, paragraph 2.2) further discloses, further comprising: truncating the sample space by eliminating a

subset of the sample space modes, the eliminated modes generally having the lowest eigenvalues.

As to claim 21, Swets discloses, a method of encoding a data sample [MEF and MDF approximate the features of the image and reduce the features size (i.e., encoding) (page 831 paragraph 2.1.1)] relating to an object to enable the object to recognized, comprising:

constructing a sample space using the method of claim 4 (refer to claim 4 rejection);

providing a raw matching score between said data sample and each of the plurality of basis sample elements [an image query (data sample) is projected on each of a training set of images (basis or reference sample elements) in the MEF and MDF subspaces. This projection is in effect an overlap image score to compare the score of the encoded MEF and MDF vectors in eigenspace of the image query with the score of the training set of images obtain a raw matching score used for recognition (page 834, paragraph 2.3, page 835, paragraph 4)]; and

mapping the raw matching scores of said data sample into truncated sample space scores [the MEF and MDF projections construct an approximated (truncated) sample space from the raw matching scores (Fig. 1), the sample space being defined by a basis set of sample space modes, the approximated sample space is defined by the principal component directions or modes Y1 (or E) (page 832, LC, lines 1-4, Fig. 1)].

As to claim 22, Swets discloses, a method of recognizing whether a probe data sample (query image) matches one of a plurality of known data samples (training image set) comprising:

encoding the known data samples using the method of claim 21 (refer to claim 21 rejection) and storing the results in a reference database [the set of MEF and MDF are generated for each of the training set of images (basis or known or reference samples) and is stored in recognition module (reference database) (page 834, LC, paragraph 2.3)];

encoding the probe data samples using the method of claim 21 (refer to claim 21 rejection) [an image query (probe or test data sample) is projected on each of the training set of images (known or reference samples) in the MEF and MDF subspaces, i.e. the MEF and MDF of the probe image is generated and projected on the MEF and MDF of each of the training set of images, which means that the probe image is also encoded in the MEF and MDF subspaces ((page 834, paragraph 2.3, page 835, paragraph 4)];

measuring the distance between the sample space scores for the probe sample and each known sample in the sample space (page 834, paragraph 2.3); and

determining which encoded known sample is nearest to the encoded probe sample in the sample space (page 834, paragraph 2.3).

As to claim 33, refer to claim 3 rejection.

As to claim 34, refer to claim 4 rejection.

7. Claim 48 is rejected under 35 U.S.C. 103(a) as being unpatentable over Daniel L. Swets et al., "Using Discriminant Eigenfeatures for Image retrieval", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 18, No. 8, pp 831-838, August 1996 as applied to claim 31 above and further in view of P. Jonathan Phillips, "Support Vector Machines Applied to Face Recognition", Advances in Neural Information Processing Systems 11, M.J. Keans, S.A. Solla, and D.A. Chon, MIT Press, 1999.

As to claim 48, Swets further discloses, wherein the objects are persons, the data samples represent faces of the persons, and the system is used to perform face recognition (see Fig. 2). Swets does not disclose, the data samples represent fingerprints of the persons, and the system is used to perform fingerprint recognition.

Phillips discloses a system for face recognition using SVMs to compute the probability of correctly identifying the probes for a set of face spaces parameterized by the first n Eigenfeatures (paragraph 7). The system is generalized to other biometrics such as fingerprints (paragraph 8). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use phillips's teachings to modify the system of Swets by using data samples represent fingerprints of the persons, and to perform fingerprint recognition in order to increase the utility of the system because fingerprint is the biometric data that most widely used by recognition and identification systems to recognize and verify subjects.

Allowable Subject Matter

8. Claims 5—17, 35-43, 45-46 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

As to claim 5, the prior art of record do not disclose or suggest, wherein truncating the sample space comprises

determining a sample space score between each of a plurality of data samples in a second sample database and each of the sample space modes, the samples in the second sample database being out-of-sample with respect to the basis samples and the samples in the first sample database; and

selecting a cut-off for eliminating a subset of sample space modes based on the distribution of said sample space scores for each of the sample space modes, the distribution being indicative of how well a sample space mode is able to discriminate between samples.

As to claim 7, the prior art of record do not disclose or suggest, further comprising:

determining a first common object sample space score between each of a plurality of data samples in a first common object sample database and each of the sample space modes;

determining a second common object sample space score between each of a plurality of data samples in a second common object sample database and each of the

sample space modes, the first and second common object sample databases each having a set of different samples for the same objects; and

constructing a recognition space from the first common object sample space scores and the second common object sample space scores, the recognition space being defined by a basis set of recognition space modes.

As to claim 35, the prior art of record do not disclose or suggest, further comprising a recognition space construction module for receiving a plurality of data samples in a first common object sample database and plurality of data samples in a second common object sample database, the first and second common object sample databases each having a set of different samples for the same objects; wherein the recognition space construction module determines a first common object sample space score between each of the plurality of data samples in the first common object sample database and each of the sample space modes and further determines a second common object sample space score between each of the plurality of data samples in the second common object sample database and each of the sample space modes, the recognition space construction module constructing a recognition space from the first common object sample space scores and the second common object sample space scores, the recognition space being defined by a basis set of recognition space modes.

Claims 23-26 would be allowable if rewritten in a form to overcome the 112, second paragraph including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Samir A. Ahmed whose telephone number is 703-305-9870. The examiner can normally be reached on Mon-Fri 8:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on 703-308-6604. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-746-6010 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-303-3900.

SA
8/18/03

SAMIR AHMED
PRIMARY EXAMINER